NOAA FISHERIES

West Coast Fisheries Science Centers

2.0 Salmon recovery science overview

May 4, 2015

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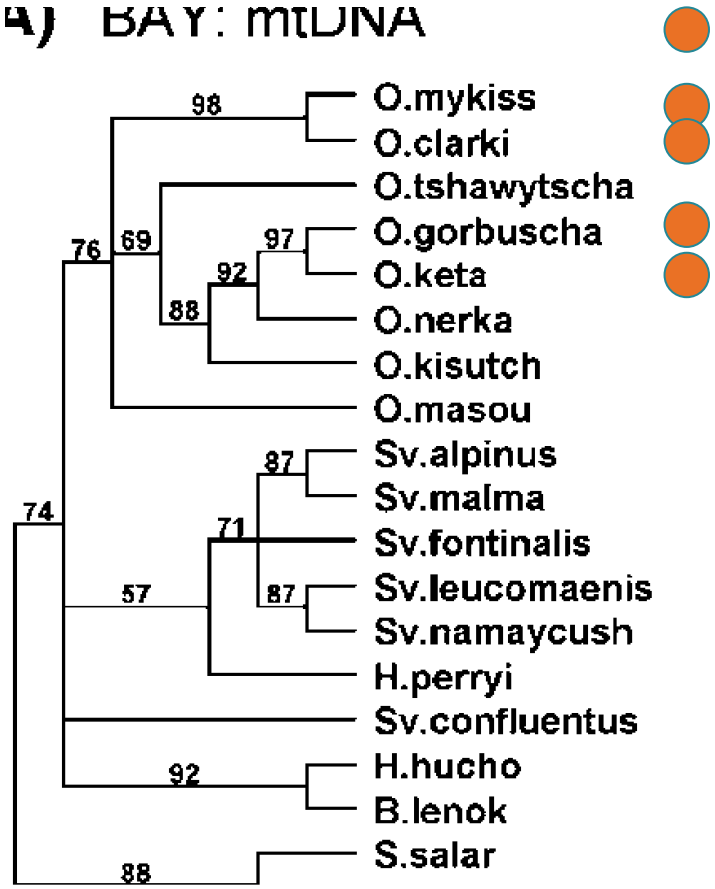
Biological background

- Who's who



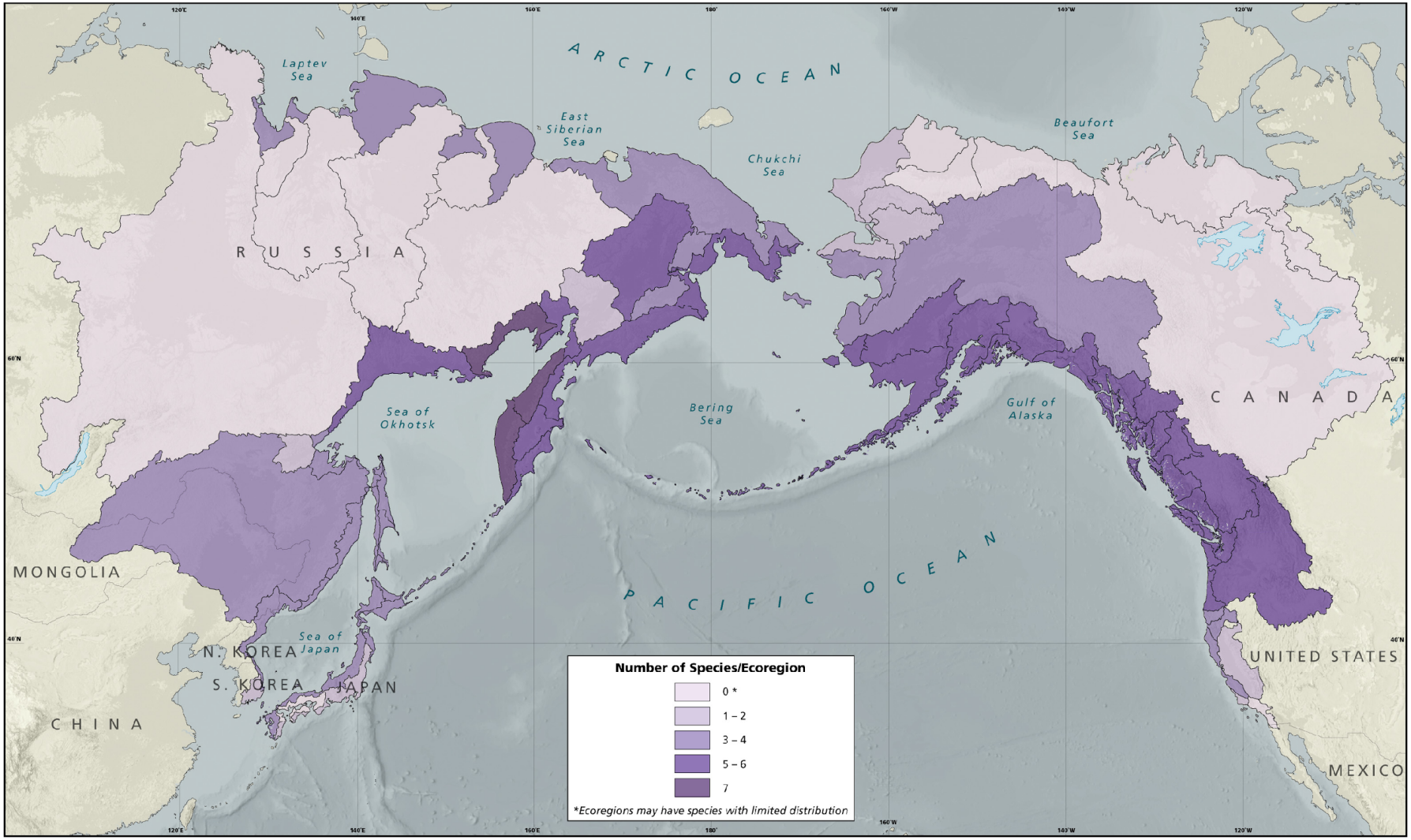
Source: Crespi and Fulton 2004

- 8 *Oncorhynchus* sp.
- 5 contain listed populations

Biological characteristics:

- Anadromous
- Semelparous
- Widely distributed
- Homing
- Rapidly growing

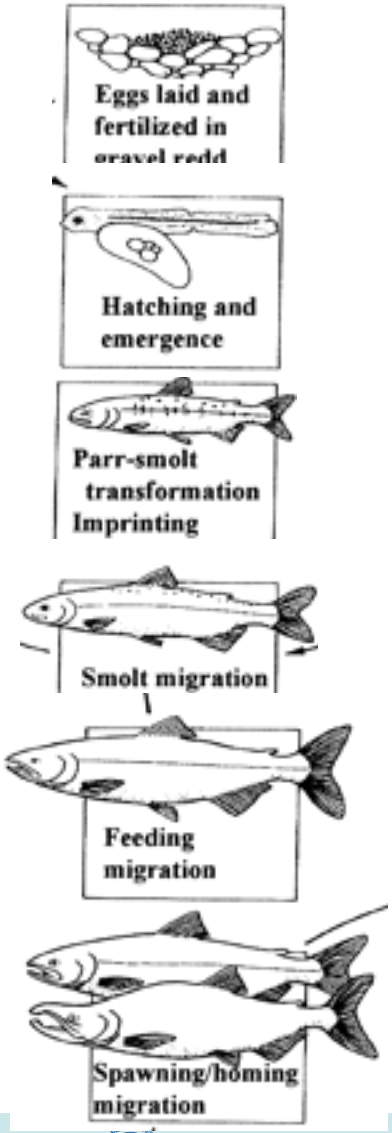
Distribution



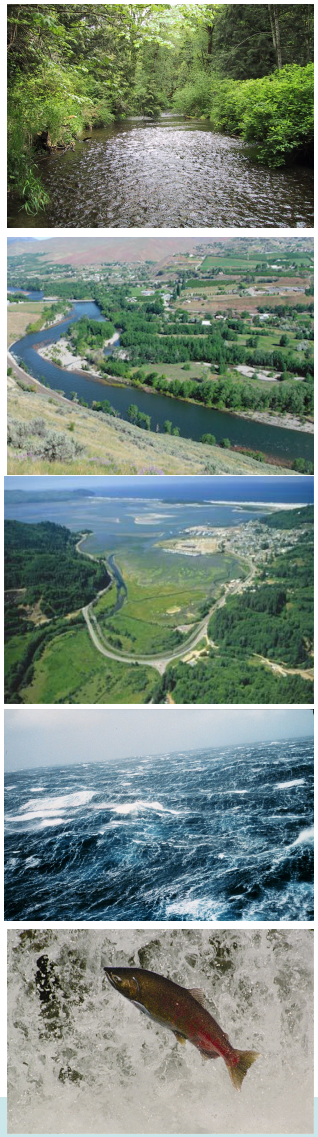
Source: Ecotrust

Life Cycle and threats

Stage



Habitat



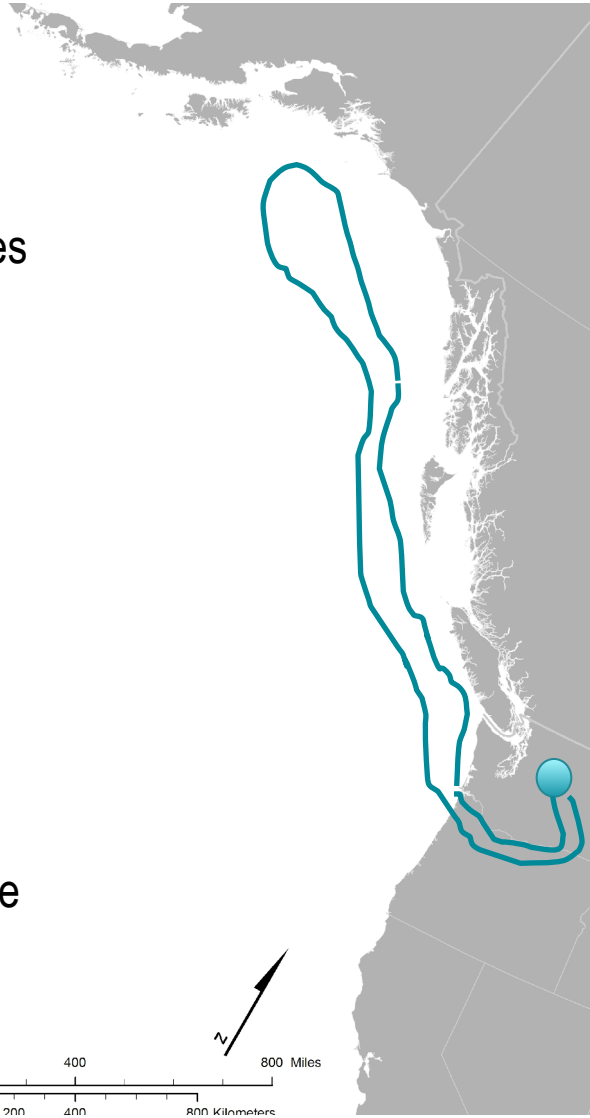
Impacts

- Forestry
- Agriculture
- Urbanization
- Invasive species
- Mining

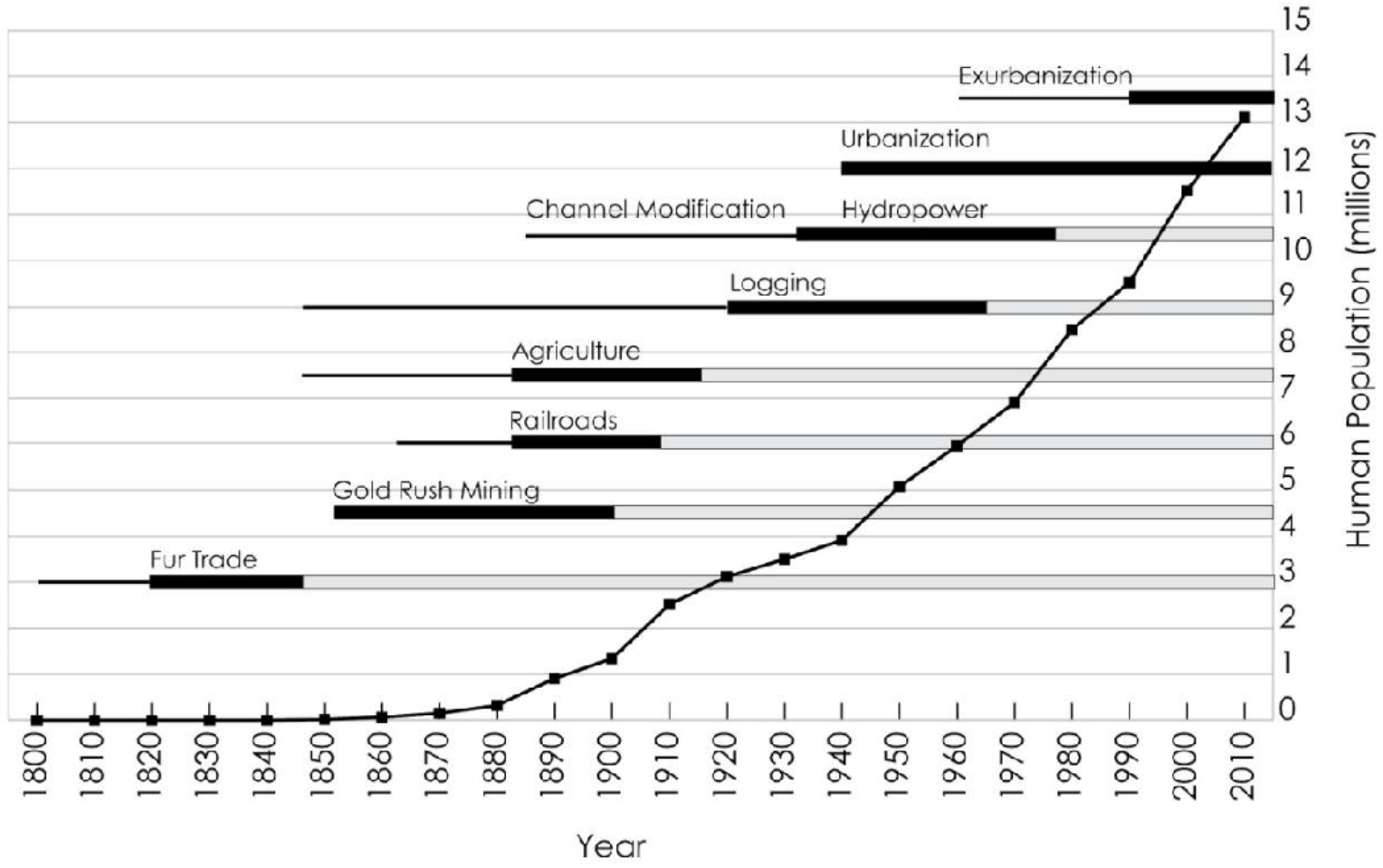
- Pollution
- Urbanization
- Hydropower
- Predation

- Harvest
- Hydropower
- Predation

- Climate change
- Hatchery interactions



History of salmon decline

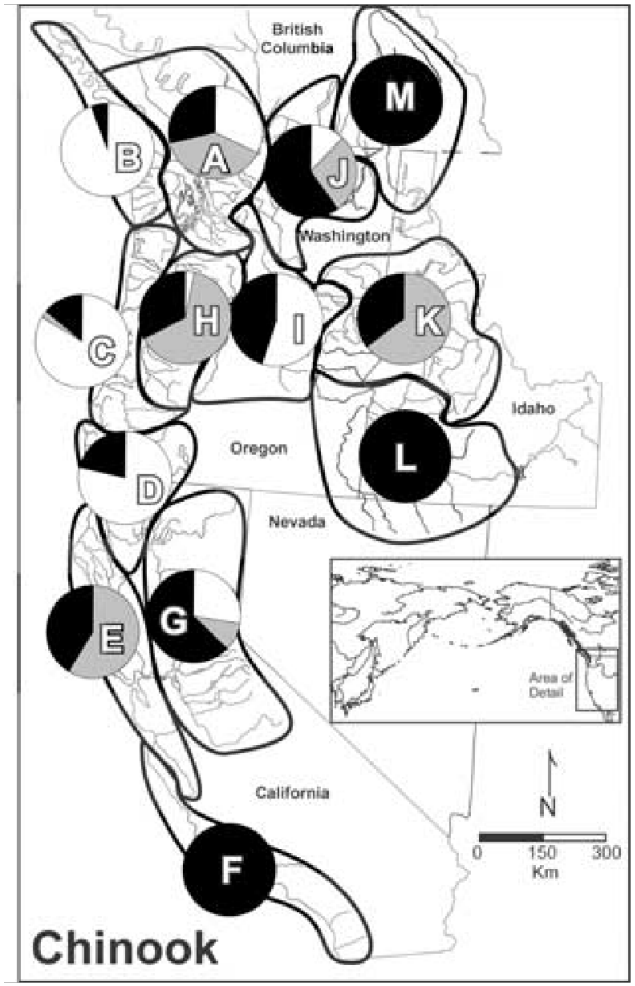


Source: ISAB

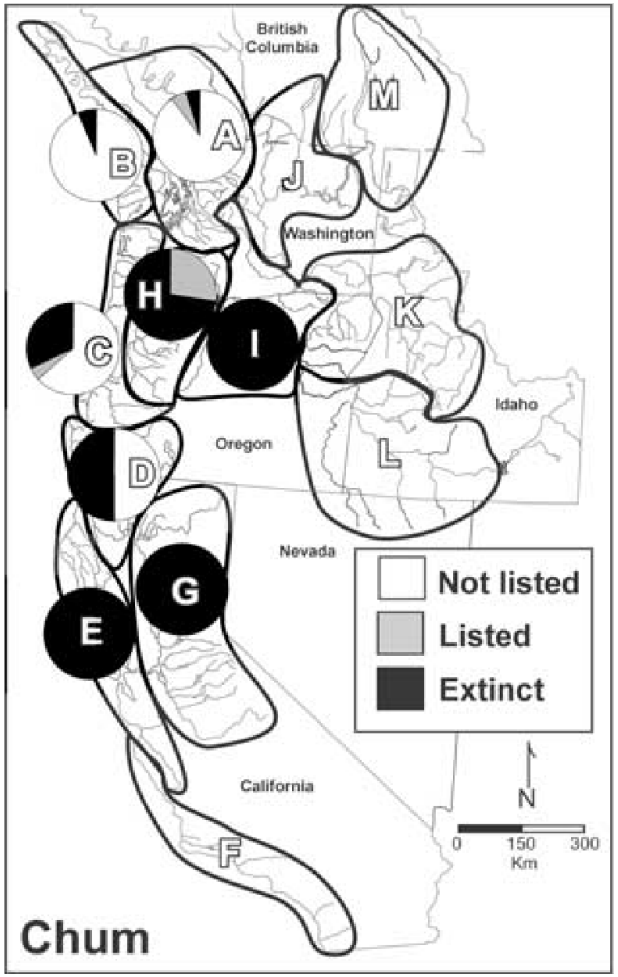
Some salmon conservation milestones

- Pre-history – early 1800's : management by Native Americans
- 1848 : Oregon Territory constitution prohibits obstructing salmon streams
- 1850's : treaties with tribes to ensure rights to salmon
- 1859: Fishing regulation on the Columbia River
- 1871 : Spencer Baird appointed Commissioner of the US Fish Commission
- 1872: First Pacific salmon hatchery built on McCloud River, CA
- 1882 : Livingston Stone (UFSC) call for creation of a salmon park in Alaska
- 1905 : Supreme Court upholds Indian Treaties
- 1917 : Purse seining outlawed on Columbia River
- 1934 : Fish and Wildlife Coordination Act
- 1938 : Mitchell Act
- 1939 : Grand Coulee Fish Maintenance Project
- 1952 : Pacific Salmon Treaty with Canada and Japan
- 1970 : Congress creates Environmental Protection Agency
- 1971 : Oregon Forest Practice Act
- 1973 : Endangered Species Act
- 1974 : Boldt Decision
- 1976 : Magnuson Act, Lower Snake River Compensation Plan, National Forest Management Act
- 1977 : Columbia InterTribal Fish Commission
- 1978 : First ESA status review for Pacific salmon (not completed)
- 1982 : Northwest Power Act
- 1985 : Pacific Salmon Treaty with Canada
- 1989 : Sacramento winter-run Chinook listed under ESA
- 1991: Nehlsen et al. publish Salmon at the Crossroads
- 1991: NMFS adopts ESU policy
- 1992 : Oregon wild fish policy
- 1992: Central Valley Project Improvement Act
- 1993: First FCRPS Biological Opinion
- 1994 : Northwest Forest Plan
- 1995 : Start of NMFS coastwide salmon status reviews
- 2000 : Congress creates Pacific Coast Salmon Recovery Fund
- 2001 : NMFS establishes technical recovery teams
- 2005 : Final NMFS policy on evaluating hatchery salmon for ESA listing
- 2008: Columbia River Fish Accords
- 2009 : Hatchery Scientific Review Group reports to Congress

Many losses are due to extirpations



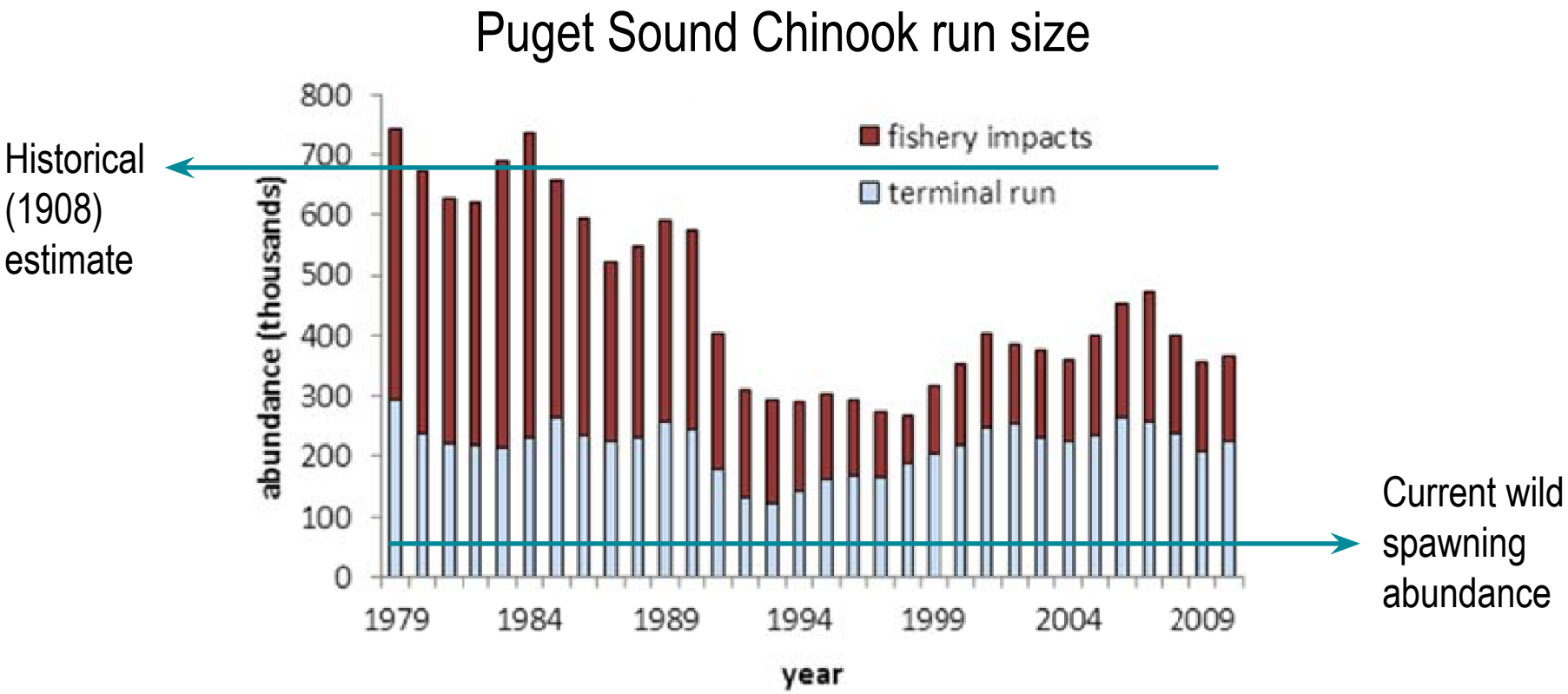
159/396 populations extirpated



23/112 populations extirpated

Source: Gustafson et al. 2007

Hatchery production



Source: Robert Kope, PFMC, PSC

The role of the NMFS Science Centers in salmon conservation

- ESA status reviews
- Support for recovery planning
- Research and analysis to support ESA implementation
- Collaboration and partnerships

Key ESA listing questions

- What taxonomic units to consider for listing?
  - Is a population a DPS?
- Is the species/DPS in danger of extinction?
- What is required to recover a listed species?

1991 NMFS policy says a DPS == an Evolutionarily Significant Unit

- U.S. Endangered Species Act allows listing of "distinct population segments"
- DPS not defined in the Act
- Series of ESA petitions in early 1990's == need to define what a DPS is for Pacific salmon

Definition of an ESU:

Population or group of populations that is

1) Substantially reproductively isolated, and

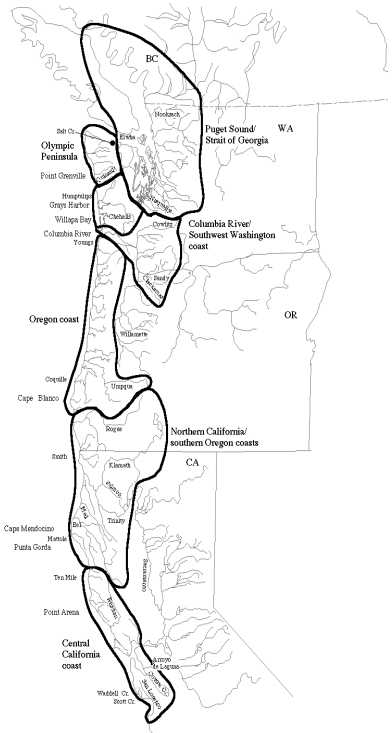
2) Is an important component of the evolutionary legacy of the species

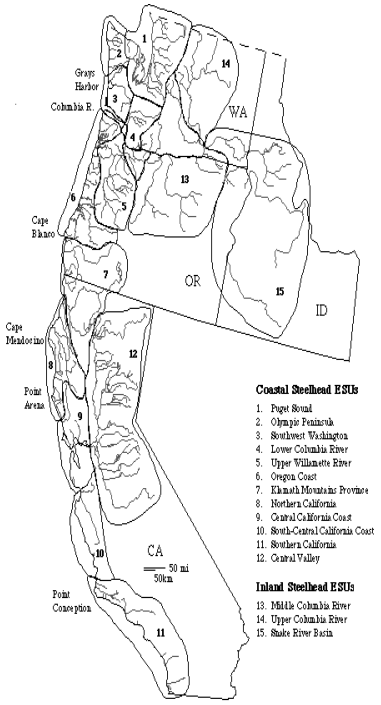
Waples (1991)

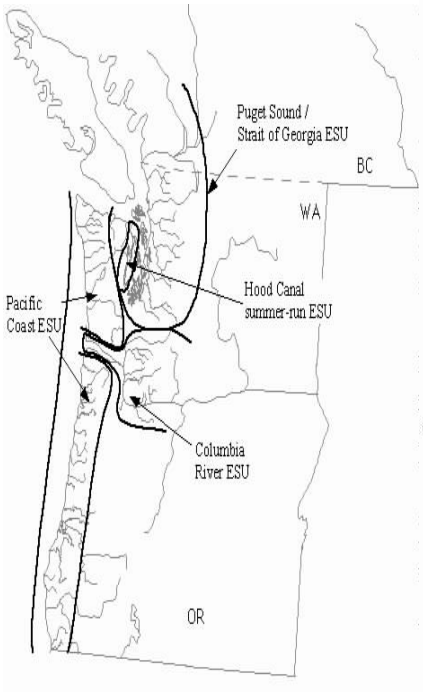
Types of data used to identify ESUs

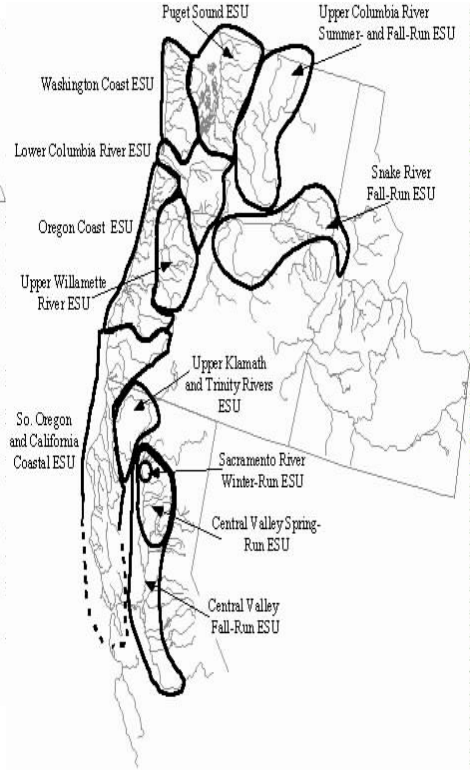
- Reproductive isolation
  - genetic variation
  - geography
  - tagging data
- Evolutionary legacy
  - life history and morphological variation
  - environmental and ecology features
  - degree of genetic differentiation

Results for 4 species:



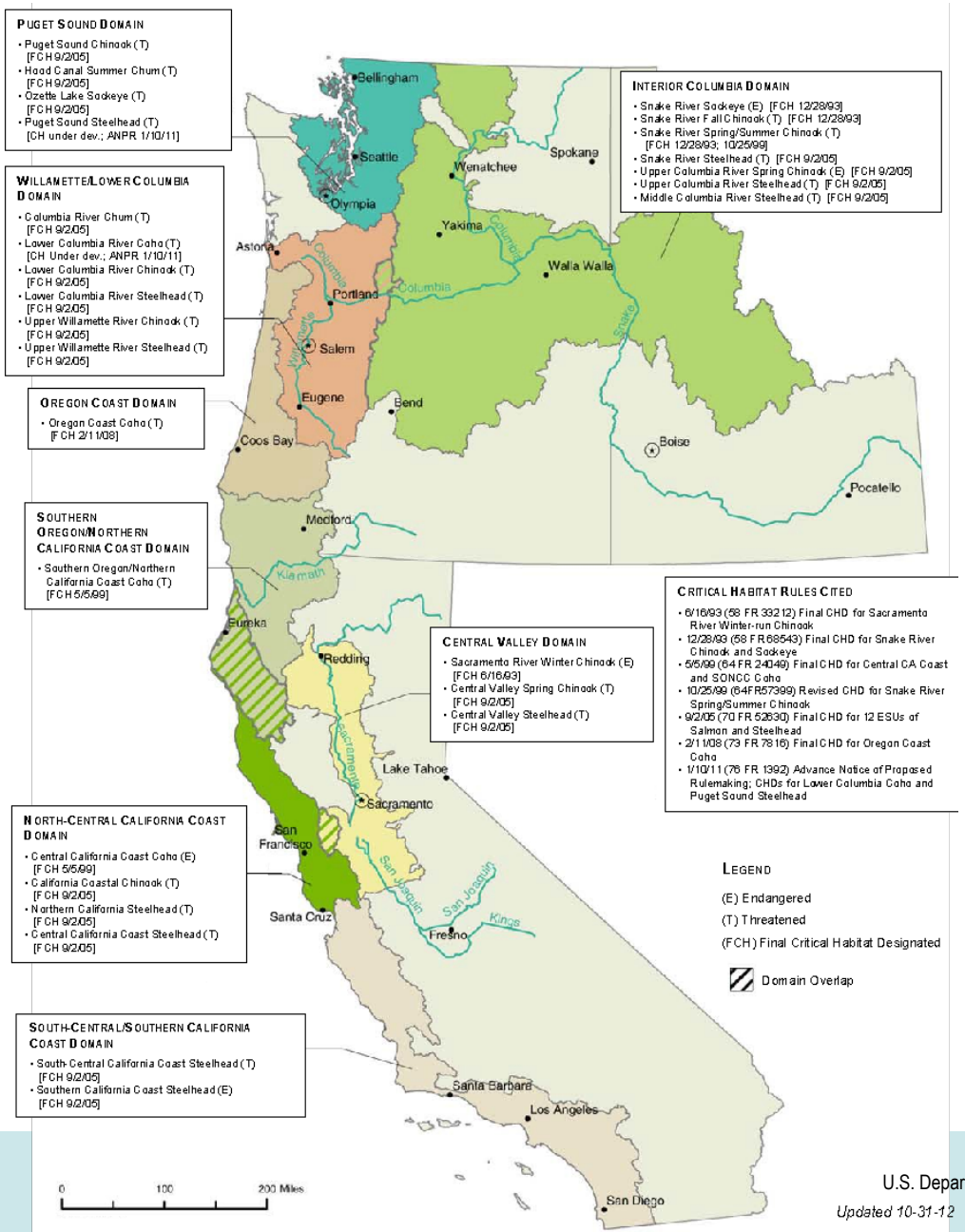






	coho	steelhead	chum	Chinook
ESUs	6	15	4	17
listed	4	11	2	9

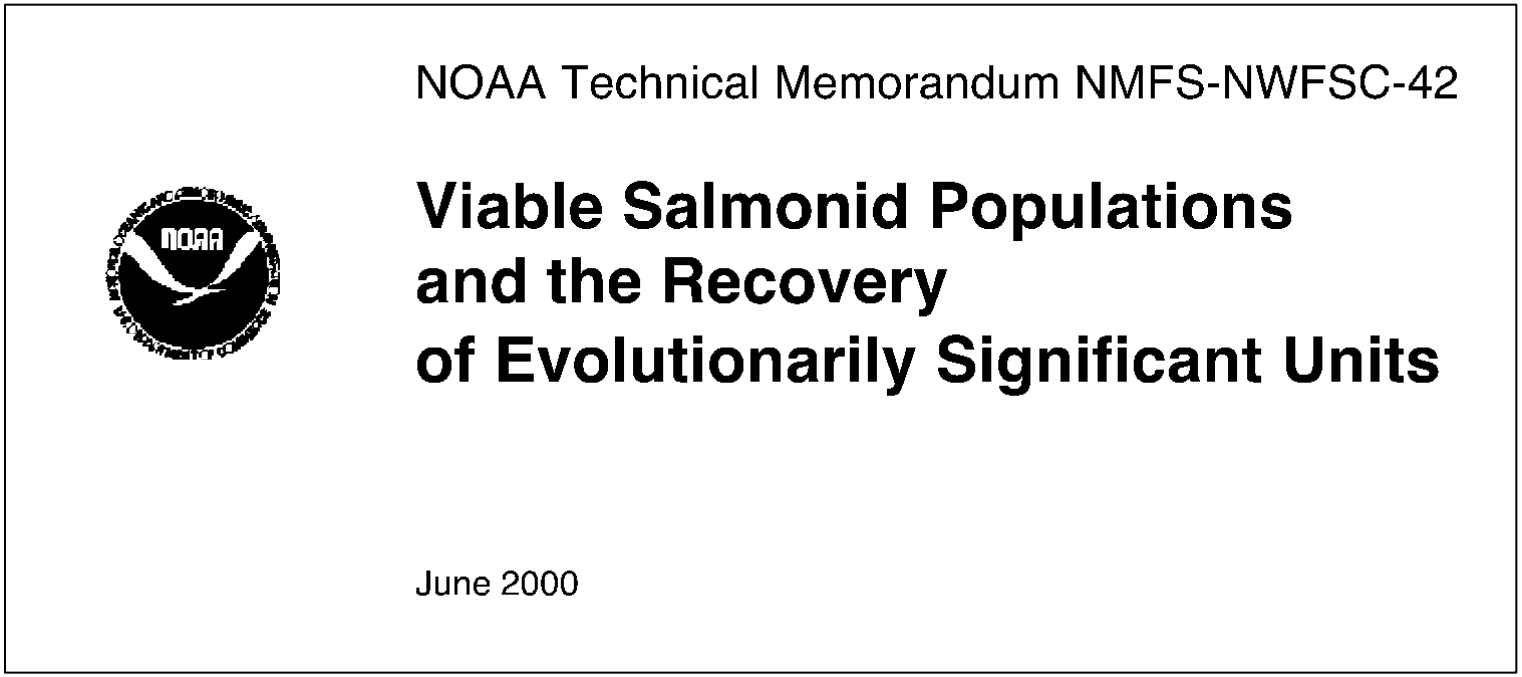
ESA status reviews



- 28 listed DPS
- Listings from 1989 – 2007
- Early reviews (‘87 – ’94)
  - Response to petitions
- Middle listings (’95-’98)
  - Coastwide reviews
- Later Reviews (2005-2007)
  - Response to court decisions, petitions
- 5 year status reviews
  - 2005, 2011, 2016

Updated 10-31-12

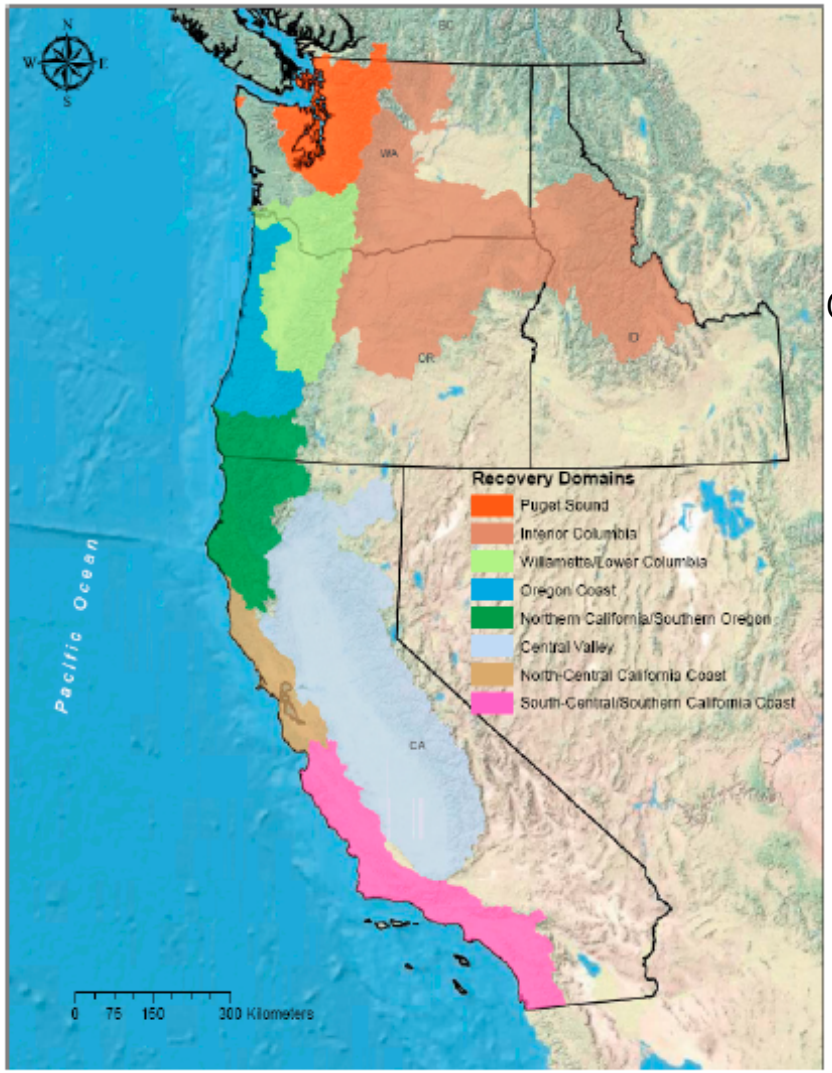
After the listings – support for recovery and regulation

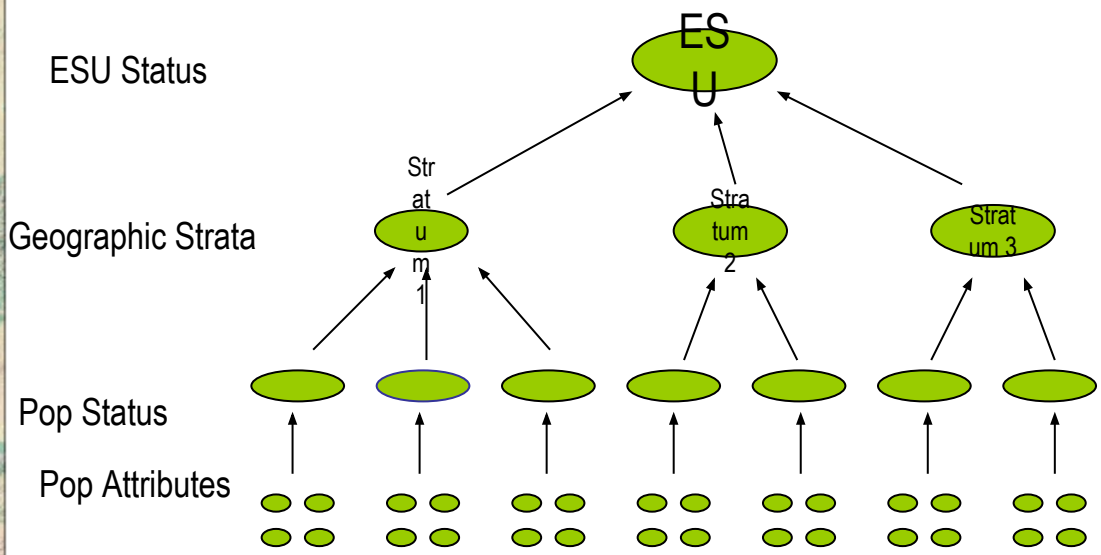


Technical Recovery Teams

- Multi-agency, collaborative, chaired by NWFSC or SWFSC scientists
- Identify current and historical natural populations
- Set criteria for viability, based on Viable Salmonid Population principles
- Work with regional planners to develop recovery plans

ESU Viability assessment





Population status:

- Abundance (typically natural origin spawning)
- Productivity (trend, recruits/spawner, modeled)
- Spatial structure (distribution, habitat)
- Diversity (life-history, genetic, hatchery/wild)

Criterion	Risk of Extinction: High	Moderate	Low
Extinction risk from PVA	> 20% within 20 years	> 5% within 100 years	< 5% within 100 years
	– or any ONE of –	– or any ONE of –	– or ALL of –
Population size[a]	$N_e \leq 50$	$50 < N_e \leq 500$	$N_e > 500$
	–or–	–or–	–or–
	$N \leq 250$	$250 < N \leq 2500$	$N > 2500$
Population decline	Precipitous decline[b]	Chronic decline or depression[c]	No decline apparent or probable
Catastrophe, rate and effect[d]	Order of magnitude decline within one generation	Smaller but significant decline[e]	not apparent
Hatchery influence[f]	High	Moderate	Low

[a] Census size N can be used if direct estimates of effective size N_e are not available, assuming $N_e/N = 0.2$.

[b] Decline within last two generations to annual run size $\leq$ 500 spawners, or run size $>$ 500 but declining at $\geq$ 10% per year. Historically small but stable population not included.

[c] Run size has declined to $\leq$ 500, but now stable.

[d] Catastrophes occuring within the last 10 years.

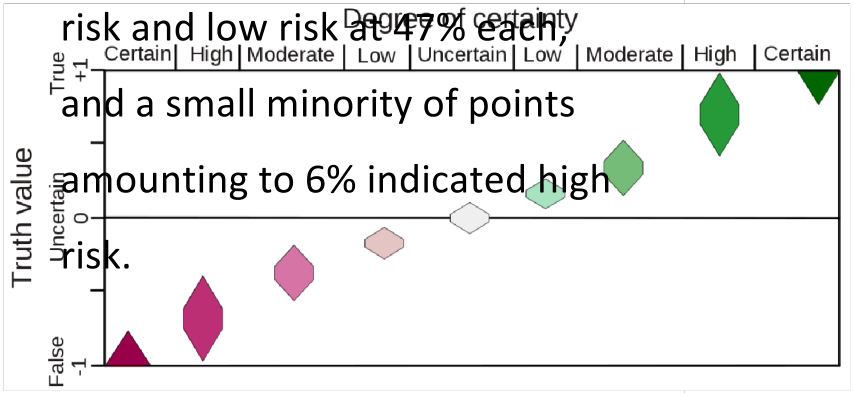
[e] Decline $<$ 90% but biologically significant.

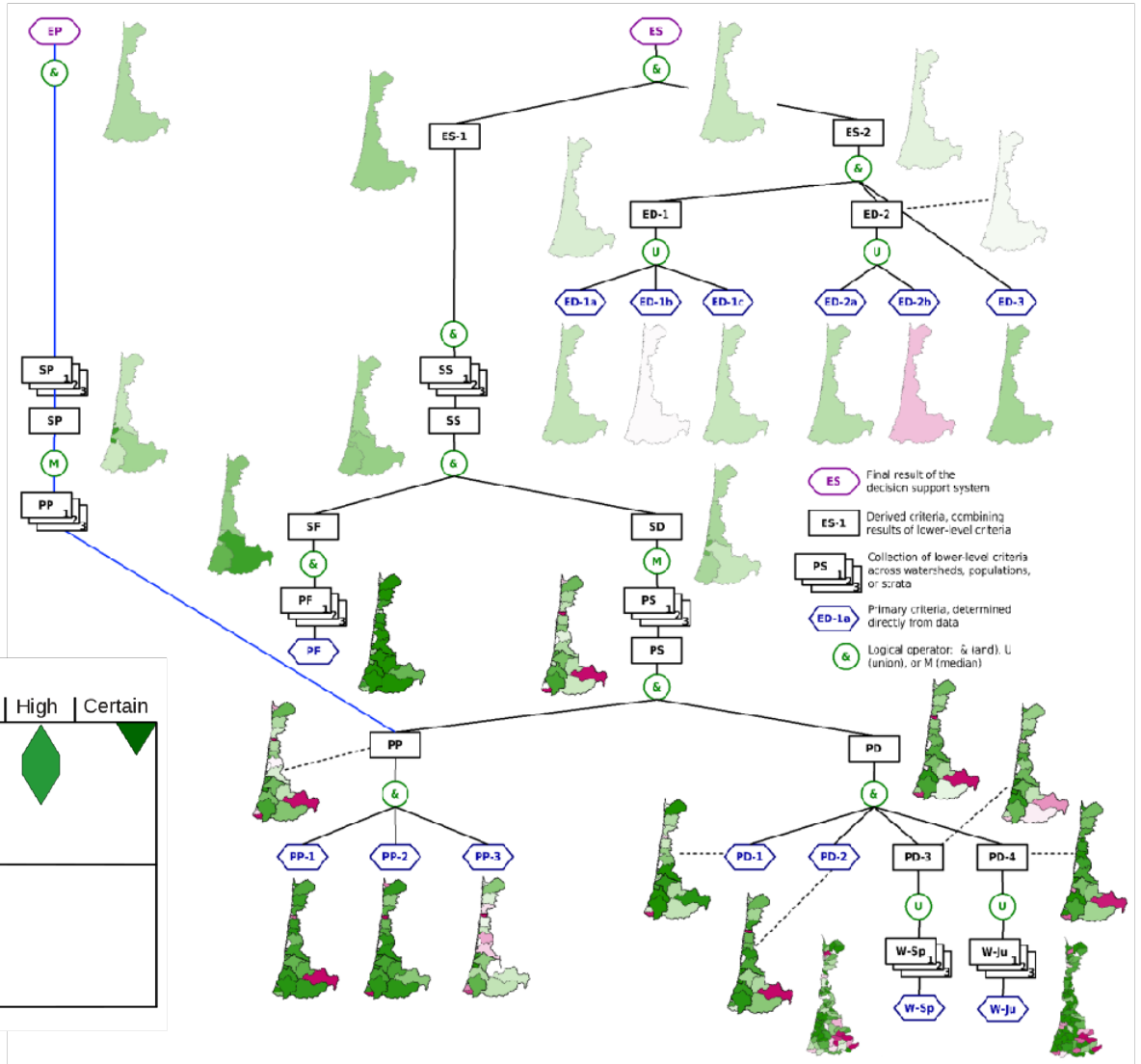
[f] See Figure 1 for assessing hatchery impacts.

Lindley et al 2007. San Fran Est Water Sci 5(1),
Extended from Allendorf et al 1997. Cons Biol 11(1)

Risk summary – Oregon coast coho decision support system

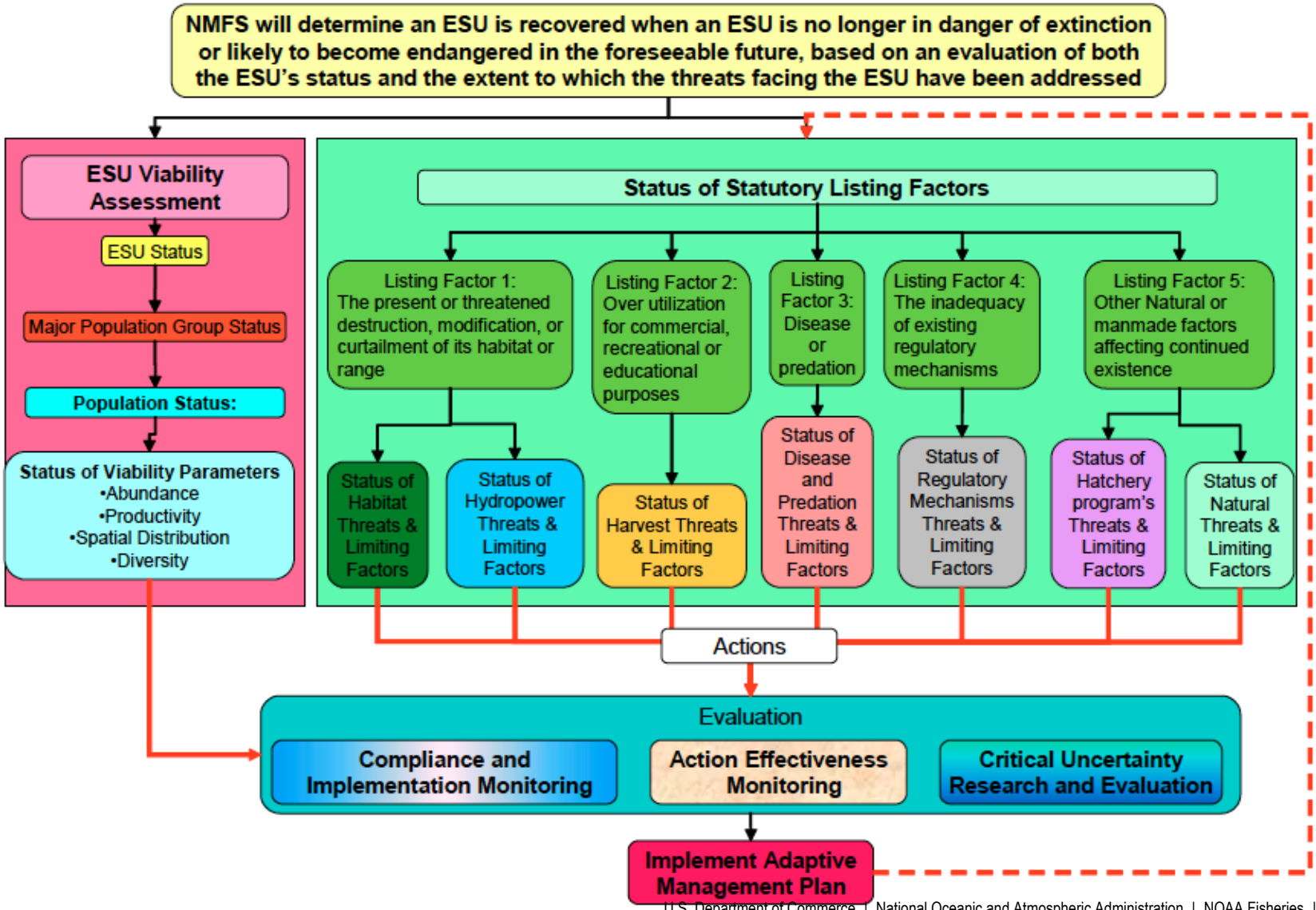
The overall assessment of extinction risk to the OCCS ESU, taking into account both the demographic risk parameters and an evaluation of threats, indicated considerable uncertainty about its status; most likelihood points were evenly split between moderate risk and low risk at 47% each, and a small minority of points amounting to 6% indicated high risk.





Stout et al. 2012 – Oregon coast coho salmon status review

NMFS Listing Status Decision Framework



Partnerships

- State and tribal agencies
  - EG: CA, OR, WA, ID, AK, CRITFC, NWIFC, many ind. tribes
- Other federal agencies
  - BPA, ACE, FS, FWS, USBR
- Local government
- Public Utility Districts
- Watershed planning groups
- Universities
- BC and Canada

Strengths

- Highly qualified, motivated staff
- History of innovation and scientific contributions
- Good ties between science and management
- Positioned to see the big pictures and work coast wide
- Science has made a big difference in directing recovery, e.g.
    - Fish passage
    - Hatchery reform
    - Habitat conservation

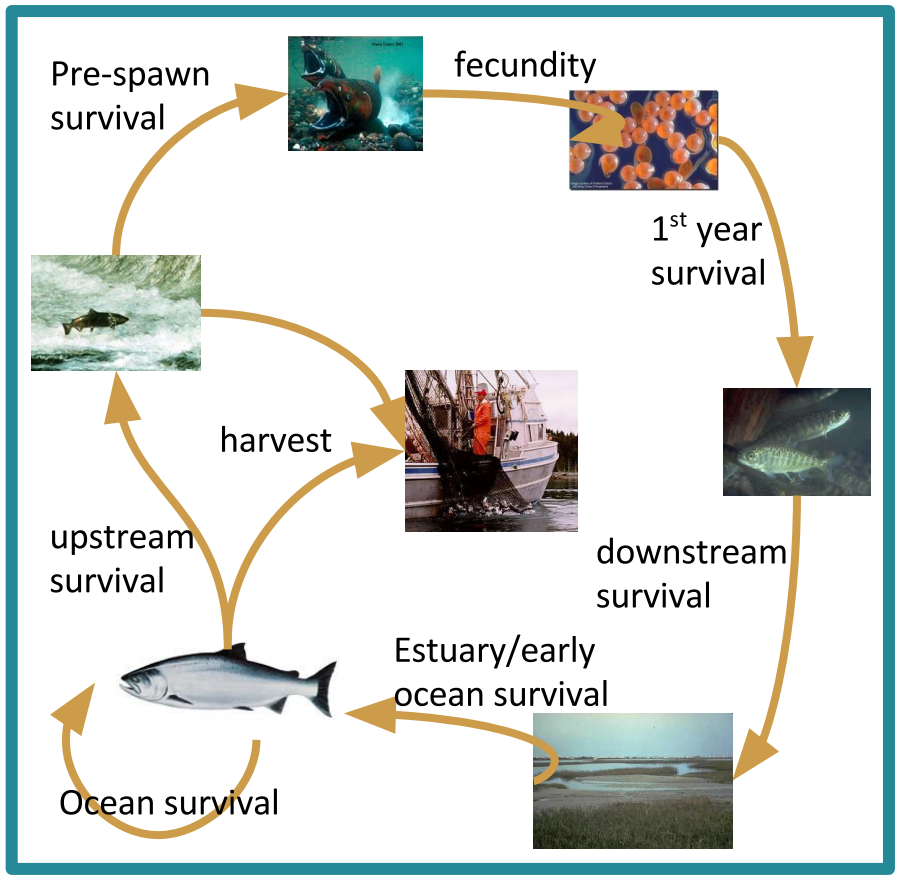
Challenges

- Salmon recovery will take a long time and lots of resources
  - Congressional salmon fatigue
  - Public concern for slow pace of progress
  - Climate change will make things worse
  - Funding is has been flat or declining as costs have increased
    - Smaller, older, more expensive workforce
    - Greater reliance on soft money
- Tensions between mandates
  - Successful conservation and recovery of wild salmon while maintaining large scale hatchery production for mitigation and fisheries
  - Trust responsibilities
  - Other species (marine mammals, birds, orcas, sturgeon)

Opportunities

- Some ESUs are approaching delisting goals for some criteria
- More and better interactions between the NMFS Science Centers
- New technology is helping to answer some long-standing questions
- Greater focus on ecosystem approaches to management

Structure of review



Agenda loosely follows the salmon life cycle and associated impacts:

- Freshwater habitat research
- Climate
- Riverine survival
- Estuarine ecology
- Ocean ecology and harvest
- Hatcheries and captive breeding
- Life cycle modeling and synthesis